Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.07.002

Fruit Quality Detection Using Medical Image Processing

Thilak Raj M[1], Kavikarthik K[2], Nithish Kumar S.R[3], Shankar K.R[4]
[1,2,3,4]Department of Information Technology, K. S. Rangasamy College of Technology, Tiruchengode, Tamilnadu
***Corresponding author:** Thilak Raj M, Department of Information Technology, K. S. Rangasamy College of Technology, Tiruchengode, Tamilnadu, Email: mthilakraj@ksrct.ac.in

Submitted: 20 February 2023; Accepted: 15 March 2023; Published: 02 April 2023

ABSTRACT

The equilibrium between the soil, plants, animals, and human health has been disrupted by the increased use of chemicals in intensive farming. Those who are concerned about their health have been encouraged to learn more about and support organic farming because of the significant usage of pesticides and antibiotics in inorganic food production systems. The study found that compared to other types of food, food grown organically tastes better and has a higher ratio of vitamins and minerals. The danger of heart attacks, colon cancer, and other ailments is significantly decreased by eating organic food. Due to its environmentally friendly practices and rising consumer awareness of food safety, organic farming has gained popularity. The government is vital in encouraging farmers to switch from inorganic to organic agriculture systems since organic farming is economically viable in the country.

The government must also take the necessary steps, including establishing a separate market for organic products, announcing a support price, increasing awareness-raising efforts through more programs, subsidizing suppliers of organic inputs, encouraging organic farmers with subsidies, accrediting farms, and boosting investment in research and development of organic farming methods.

Keywords: *Fruit quality, image processing, Tensor flow, Algorithm, organic, non-organic*

INTRODUCTION

Globally, the agro-food sector is growing quickly. According to a poll that was carried out over the 2019–20 academic year, the growth rate jumped to 2.9 percent [1]. Organic food is becoming more and more popular among consumers because of its high quality and security. On the farms, fruits and vegetables are grown using both traditional and organic techniques. The plants must be protected from the earth in the first place. There shouldn't be any pesticides, herbicides, fungicides, or other chemicals in the soil that is utilised for cultivation.

The plants used to cultivate vegetables or fruits in the ground must have an adequate supply of protein, iron, calcium, micronutrients, magnesium, and other minerals. Spectroscopy-based analysis as well as other methods. In agrofood analysis, the chemical approach is employed to evaluate food products on a quantitative and qualitative basis. NIR measurements are easier to do than chemical process analysis (Near Infra-Red). It is crucial to reduce the size, weight, cost, safety, and complexity of the spectrometer while also enhancing measurement precision and performance.

The internal parameter was determined by ANOVA to be the sugarto-acid ratio ($p = 0.04$). In an experiment [4], yellow plums were used to compare the amounts of organic and non-organic nutrients. The results of the trial showed that plums grown organically had the highest levels of antioxidant vitamins like beta carotene and alpha-gamma tocopherols, as well as nutrients like flavanols, total polyphenols, and phenolic acids. The antioxidant content of both conventional and organic plums was not significantly different. The developed soil is used to grow conventional plums.

The nitrate content of a batch of 75 pineapples was assessed using the Vis-NIR spectroscopic technique between 400 and 2500 nm [5]. The HPLC was used to establish the precise nitrate content in real pineapple flesh. The PLSR's 95% correlation coefficient (R) demonstrates how effectively it forecasts outcomes. Between 600 and 1200 nm in wavelength, nitrate was discovered to exist. Five spectroscopic spectra with varied wavelength ranges between 350 and 2100 nm are used in another analysis technique [6]. The NIR spectrometer outperforms the other four in terms of performance. Fruits from organic and non-organic sources can be distinguished using spectral data and the presence of nitrogen-15. With the Linear SVM classifier, this destructive machine learning classification achieves accuracy of 96% to 99%.

Nitrite and nitrate ions can be found in fruits and vegetables using electron paramagnetic resonance spectrometry (EPR) [7]. EPR analysis was performed on 18 fruits and vegetables that were purchased from local markets, some of which were cultivated using mineral fertilizers. The results were compared with those produced using organic fertilizers. The results demonstrate that by combining with Mon nitrosyl diethyldithiocarbamate, which shows EPR activity, this method offers good sensitivity and selectivity.

LITERATURE SURVEY

The literature study includes a number of categorization and recognition systems that might automatically check fruits for diseases, a fruit's stage of maturity, category recognition, etc. The method used by [6] to classify the bananas using the hue channel and CIElab. In the course of the particle swarm optimization (PSO) procedure, the fuzzy parameters were altered. Using a multi-class kernel support vector machine, [7] classified fruits (kSVM). SVMs were trained using a 5-fold stratified crossvalidation procedure and a reduced feature vector. A combination of color, texture, and shape features were used during the categorizing process. Convolution neural network (CNN), a special multi-layered feed-forward unsupervised neural network, was developed to perform image classification. The convolution layer of a convolution neural network is also known as the feature extraction layer (CNN).

In the proposed project, CNN is used to build coarse and fine labels and extract fruit picture features. Zhang et al. (2015) collected visible (RGB) and infrared (IR) images using a high-end twin camera configuration. They collected 1088 images that were RGB+IR matched from 6 different sources. They gave this dataset the moniker VAIS and made it accessible to the general public. Infrared imaging is being used to enhance performance at night. They trained VGG-16 and Gnostic Fields using SIFT features. Together, they were able to use those classifiers to obtain 87.4 daylight accuracy and 61.0 nighttime accuracy.

SYSTEM OVERVIEW

This study paper describes the classification of fruit image utilizing deep neural networks, HOG feature extraction, and K-means segmentation. SVM classifiers are used to classify ships with improved accuracy. The recommended system has the following advantage.

The proposed CNN technique reduces the number of preprocessing stages.

To increase accuracy, more form features were collected through the HOG approach.

The SVM classifier reduced the complexity of the work and improved system robustness.

A Deep Neural Network

Classification layer, convolution layer, ReLu layer, Maxpooling2d layer, fully connected layer, and Softmax layer are the layers that make up a complete 2D dimensional neural network. The classifiers' layers are discussed in depth below.

Image input layer: The Image input Layer learns the feature from the input image. The input image's size and pixels must be specified in the first step [50 50].

Convolution layer: This layer separates the features from the image's input layer and adds them to the final product.

The CNN layer, which is used to extract the features from the input image, is composed of one or more kernels with different weights. Based on the weights given to each filter, we are able to extract the features of a picture.

Image Processing Using Fruit Classification

From the perspective of an ISR operation, images of fruits may be acquired for use in a classification algorithm. Data from airborne platforms were collected using EO/IR cameras with a defined range of acquisition angles, like the MX20. One exists. This large-scale tagged fruit image dataset is superior than all others. ImageNet was developed because collecting high-quality annotated photos is expensive and data acquisition is challenging. As a result, we employ transfer learning in conjunction with CNN training and other deep-learning classification approaches on a chosen ship picture dataset. In this work, we analyze three possibilities. Several pre-trained CNN architectures of various depths:

AlexNet

Algorithm Implementation

In this research, we employed various algorithms and techniques to raise the system's accuracy. We combine the shape-related characteristics from the HOG algorithm with cnn-based feature extraction to extract all relevant features from photos.

Preprocessing

To extract the attributes of the image, we used three different learning algorithms. Three alternative learning algorithms are available: preprocessing followed by SVM, bag of features, and custom-trained convolutional neural networks utilising transfer learning. Preprocessing is followed by size resizing of all images and rgb to grey conversion.

Segmentation

A technique for segmenting a set of data into a preset number of groups is called "K mean segmentation clustering." One of the most used methods is k means clustering. It divides a group of objects using the K means clustering algorithm. It creates k separate clusters from a given amount of data. The K-means algorithm consists of two sections. Each data point is assigned to the cluster with the centroid that is closest to it in the second phase after computing the k centroid in the first phase. data into a group of k numbers of data.

Histogram Of Oriented Gradients (Hog)

One of the most straightforward and efficient feature extraction techniques is the HOG feature descriptor. It is a faster and more effective feature descriptor than SIFT and LBP due to the straightforward computations. Also, it has been shown that HOG features work well as detection descriptors. It is mostly utilized for object detection in image processing and computer vision. HOG can be used to characterize the appearance and form of the image. It computes the edge directions after dividing the image into small cells, such the 4-by-4 in this study. It is possible to normalize histograms to increase accuracy.

Hybrid Method Cnn With Svm

Images of organic fruit are classified using SVM (support vector machine) classification. For the classification of ships in the Maraval dataset, a hybrid CNN-SVM model is proposed. The suggested method offers the best of both worlds by combining SVM and CNN classifiers. A convolutional neural network (CNN), which does

supervised learning, is composed of several fully connected layers. Similar to humans, CNN can learn invariant local attributes and functions. Unprocessed ship images can be used to get the most discriminating information. The suggested technique employs a 5x5 kernel/filter to extract the most recognizable elements from the raw input photographs. The nn input neurons in the convolutional layer convolve with the mm filter in the convolutional layer.

Tensor Flow

Open-source software for numerical computations is called Tensor flow. It was initially intended to be used for machine learning and deep neural network research. Users who want to employ neural networks in various scenarios can find neural network architectures in Tensor Flow along with retraining scripts.

Keras

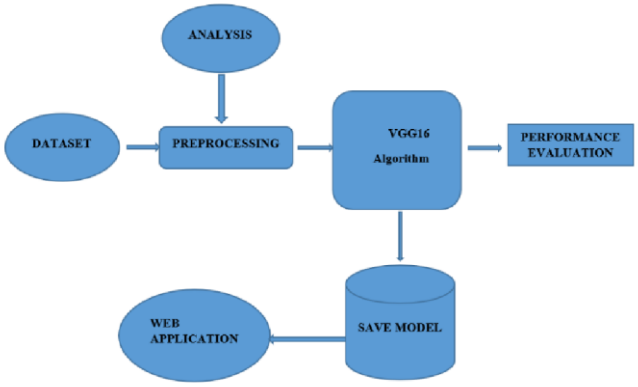
An open-source neural network library built on Python called Keras is used for preprocessing, modelling, assessing, and optimizing neural networks. It is capable of functioning on top of TensorFlow. It is utilized for high-level API because the backend is in charge of handling it. It is designed for both the training process with a fit function and the development of a model with a loss and optimizer function. It is intended for low-level computation with tensors or TensorFlow and backend convolution. For preprocessing, modelling, optimization, testing, and emotion presentation, Python libraries are imported.

Execution Environment

Intel first developed the well-known OpenCV framework for computer vision. addressing problems with computation optimization for CPU-intensive work (Kaehler & Bradski, 2016). OpenCV advances in step with advances in computer vision research. Canny detector and other conventional computer vision methods are being developed Deep learning networks are included, and it was just recently released. The C++ language is utilized with the programs that were supported, including Python, Java, and MATLAB bindings. The SIMD (Simple Instruction Multiple Data) compute capabilities of the GPU as well as its CUDA- and OpenCLbased GPU interfaces are used in the model's development to boost performance. development.

The data type tensor (a multidimensional matrix datatype with built-in support for computationally taxing operations) is an integral part of the PyTorch deep learning system. Mechanism for auto-differentiation in deep neural networks (Ketkar,2017). Python is compatible with CUDA.

SYSTEM ARCHITECTURE



EXPERIMENT RESULTS

Tensor data is a built-in data type in the deep learning system PyTorch (a multidimensional tensor). This study used the Fruit Dataset to evaluate MobileNet's superior classification performance. These 1260 images were created using the Fruits dataset and are organised into the following 7 categories: While 85% of these images are used for training, 15% are used to assess the model. The network is trained using a 14-batch size across 10 epochs. The proposed model's accuracy was 98.74%. The findings demonstrate that the suggested model outperforms more established models and holds promise for application in real-world settings. This kind of increased precision and accuracy will help increase the machine's overall fruit recognition effectiveness.

ACKNOWLEDGMENT

The authors would like to thank all faculty members of our Information Technology Department for their valuable suggestions, kind co-operation and constant encouragement for successful completion of this project

REFERENCES

1. Xiaoyang Liu, Dean Zhao,Weikuan jia, Wei Ji, Yueping Sun, “A Detection Method for Apple Fruits Based on Color and Shape Features” , IEEE Access, 22 May 2019
2. Seng, Woo Chaw, and Seyed Hadi Mirisaee. "A new method for fruits recognition system." Electrical Engineering and Informatics 2009. ICEEI'09. International Conference on. Vol. 1. IEEE, 2009.
3. Nishat Tasnim, Md. Romyull Islam, and Shaon Shuvo “A Convolution Neural Network Based Classification Approach for Recognizing Traditional Foods of Bangladesh from Food Images” Sahu, Dameshwari, and Chitesh Dewangan.
4. "Identification and Classification of Mango Fruits Using Image Processing." Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol 2.2 (2017): 203-210.
5. Shadman Sakib1, Zahidun Ashrafi2, Md. Abu Bakr Sidique3. "Implementation of Fruits Recognition Classifier using Convolutional Neural Network Algorithm for Observation of Accuracies for Various Hidden Layers
6. Hannan M.W., Burks T.F., Bulanon D.M., “A Machine Vision Algorithm for Orange Fruit Detection”, Agricultural Engineering International: the CIGR E journal, volXI,Pages:1-7, December-2009.
7. Vyas et al, “Colour Feature Extraction Techniques of Fruits: A Survey”, International Journal of Computer Applications (0975 – 8887) Volume 83 – No 15, December 2013.
8. Ms. Snehal Mahajan, Prof. S. T. Patil “Optimization and Classification of Fruit using Machine Learning Algorithm”. IJIRST – International Journal for Innovative Research in Science & Technology Vol.3- No 01 June 2016
9. V. Leemans and M.-F. Destain, ``A real-time grading method of apples based on features extracted from defects," J. Food Eng., vol. 61, no. 1, pp. 83_89, Jan. 2004.
10. T.-N. Do and J.-D. Fekete, ``Large scale classification with support vector machine algorithms," in Proc. 6th Int. Conf. Mach. Learn. Appl., Cincinnati, OH, USA, Dec. 2007, pp. 7_12.
11. Bargoti, S. and Underwood, J., 2017, May. Deep fruit detection in orchards. In Robotics and Automation (ICRA), 2017 IEEE International Conference on(pp. 3626–3633). IEEE
12. Prabha, D. Surya, and J. Satheesh Kumar. "A study on image processing methods for fruit classification." Proc. Int. Conf. on Computational Intelligence and Information Technology, CIIT 2012.
13. Kavdır, I., Guyer, D.E.: Comparison of Artificial Neural Networks and Statistical Classifiers in Apple Sorting using Textural Feature,. Biosystems Engg. 89, 331-344 (2004)
14. Shadman Sakib1, Zahidun Ashrafi2, Md. Abu Bakr Sidique3. "Implementation of Fruits Recognition Classifier using Convolutional Neural Network Algorithm for Observation of Accuracies for Various Hidden Layers
15. Xiaoyang Liu, Dean Zhao,Weikuan jia, Wei Ji, Yueping Sun, “A Detection Method for Apple Fruits Based on Color and Shape Features” , IEEE Access, 22 May 2019